FRG: Synthesis of Well-Defined Nanosize Particles and Their Role in the Formation of Simple and Composite Monodispersed Colloids

Grant DMR-0102644 PI: E. Matijević,

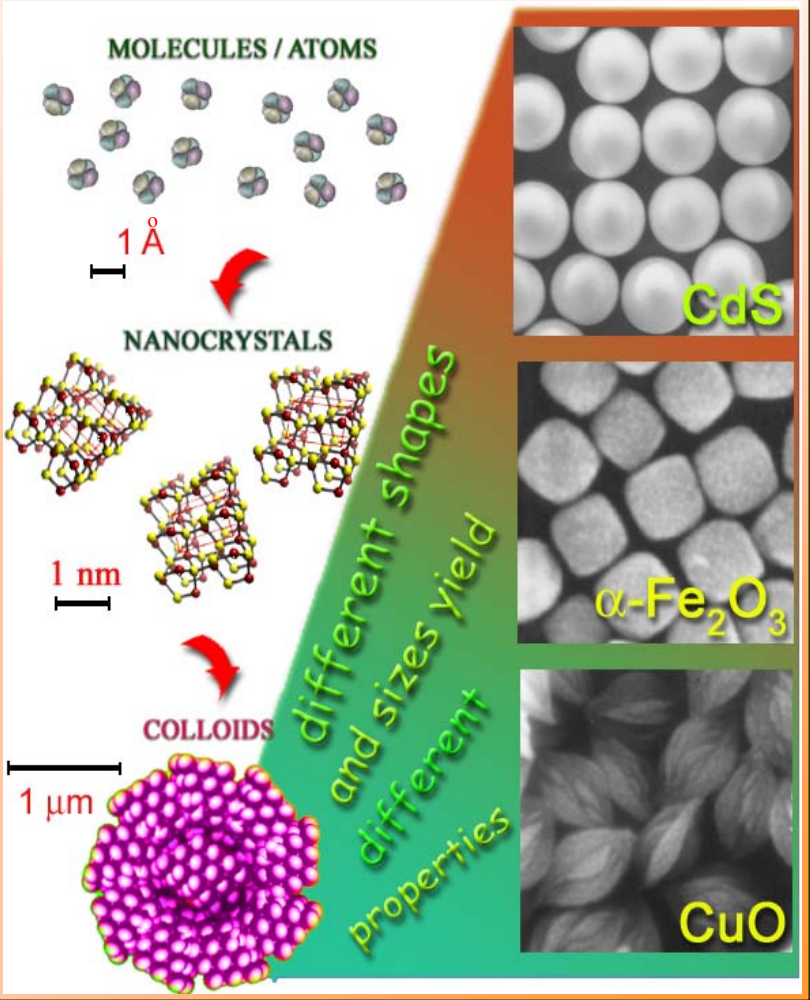
co-Pis: M. Borkovec, D. Goia, V. Privman

Objectives

- Elucidate experimentally and theoretically the formation mechanism of monodispersed colloidal particles by aggregation of nanosize precursors
- Identify the key parameters to predictably produce monodispersed particles of desired size, shape and internal structure for various applications

Achievements

- The aggregation process of nanosize precursors was studied experimentally for several representative systems (CdS, Au, Pd, CuO), and the parameters that control the size distribution and internal structure were identified
- A theoretical model, which accounts for cluster-cluster aggregation and predict the particle size selection was developed and implemented numerically. The calculations matched experimental results at different times.



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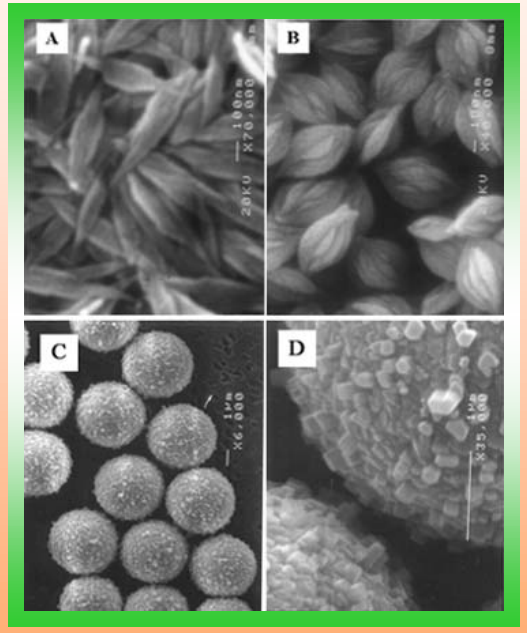
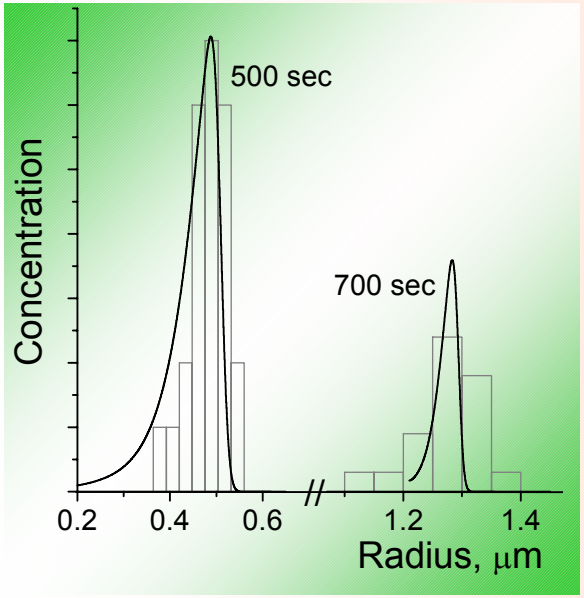
Education and Outreach

- graduate, undergraduate students and postdocs
- courses in academia (e.g., at Yale University)
- courses in industry (Ferro)
- national security applications (Army)





Industrial Applications

The understanding of the aggregation mechanism made it possible to develop commercial products in join efforts with (and funded by) industrial partners:

- catalysts for fuel cells (OMG)
- electronic materials, transparent conductive coatings (Ferro)
- fluorescent particles for medical diagnostics (Coulter)
- nanosize drugs (élan technologies)
- photolithography (Lincoln MIT Lab)
- slurries for chemical mechanical polishing (IBM, Intel)